

Zero Retries issue 0138 2024-02-09

Zero Retries is an independent newsletter promoting technological innovation that is occurring in Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology. Now in its third year of publication, with ~~1200+~~ 1300+ (!) subscribers.

About Zero Retries

Steve Stroh N8GNJ, Editor

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Web version of this issue - <https://www.zeroretires.org/p/zero-retries-0138>

Request To Send

Commentary by Editor Steve Stroh N8GNJ

Hamvention 2024, Ho!

Hamvention 2024 in Xenia, Ohio, USA countdown - ~~19 18 17 16 15~~ 14 weeks!

1300+ Subscribers!

Thank you again, Zero Retries subscribers! Zero Retries hit 1200+ subscribers as of Zero Retries 0131 on 2023-12-29. The subscriber count, in an “open” publication like Zero Retries where I make no attempt to restrict the content (such as to *paid* subscribers), is an imperfect metric of *actual* readers of Zero Retries. Per Substack’s tools, which depend on things like tracking URLs and tracking pixels, etc.), some Zero Retries subscribers have never read a single issue. Other readers choose not to receive an email subscription, but are notified via RSS feed or notifications I post on [Mastodon](#) and [Bluesky](#) (still working on using it more) social media platforms.

But, increase in subscriber numbers *is* a reasonable metric of continuing and / or growing interest in Zero Retries and its content. With that metric, continually increasing subscriber numbers is encouraging. Thus, I’ll keep writing, and again, thank you Zero Retries subscribers *and* non-subscriber readers!

It Was the Best of Times, It Was the Worst of Times...

for Amateur Radio. Developments this week offered a stark dichotomy of the future of Amateur Radio.

The best of times for Amateur Radio this week is that Amateur Radio, as a “training ground” for radio technologists was ably represented on a panel at the recent NTIA 2024 Spectrum Policy Symposium by Phil Karn KA9Q representing, nominally, ARDC... but *really representing Amateur Radio*. (See story below.)

The worst of times for Amateur Radio this week is that [CQ Amateur Radio magazine's website](#) is offline as of 2024-02-08 (or perhaps earlier; I thought to check it on Thursday for any updates on CQ's status). That grim milestone seems pretty final. *I have no other information about the status of CQ, only that observation that the website is offline*. For more context on CQ's situation from the perspective of a CQ columnist, see **Zero Retries 0131** - Print and the Digital World by Don Rotolo N2IRZ.

I take no pleasure in observing that CQ... just didn't change... (enough) with the changing economics of this century with regards to print publication, and CQ's targeted demographics and content mix. I've pointed out a number of times that when a group of motivated volunteers such as [Surrey Amateur Radio Communications](#) can publish a near-peer publication to CQ with its [Communicator](#) newsletter, with a good editing, layout, and mix of articles... *and make it available free as a PDF* (no irksome Digital Rights Management)... your business environment has *changed*.

With the Apparent Death of CQ Amateur Radio, DLARC is More Important Than Ever

The apparent death of CQ Amateur Radio magazine **underscores the importance of Internet Archive's [Digital Library of Amateur Radio & Communications \(DLARC\)](#)** in preserving Amateur Radio media and history. In addition to CQ being published for 70+ years, CQ also had an extensive content library. CQ published a number of other magazines such as CQ VHF, and inherited the content library of Ham Radio magazine after *it* ceased publication). *Hopefully*, it will be possible for DLARC to preserve CQ's extensive library of content for posterity, just as DLARC was able to do with the entire run of [73 Magazine](#).

If there is to be a future for Amateur Radio...

... beyond this decade (and I firmly believe that there is), *Amateur Radio will have to "change"*, from the current public perception that Amateur Radio is a quaint hobby of the previous century and relevant only to prior generations. That public perception (that Amateur Radio is simply "out of mind in the general public") is abundantly evident in the transcript in this issue. Many activities we in Amateur Radio take for granted such as self-education in the vagaries of radio signal propagation... are attempting to be "taught" at significant expense... and we Amateur Radio Operators can impart this wisdom for free, and in a fun way such as setting up a minimal WSPR station, transmitter hunting, and Parks on the Air (POTA).

The good news... **Best of Times**, is that Amateur Radio is exactly in a sweet spot that it is highly relevant to the coming decades and this century with the shift of communications from wirelines to radio technology, and the corresponding need for technologists skilled and experienced in radio technology (what NTIA refers to as the "spectrum workforce"). But it will take work to make that case... in time... before Amateur Radio's allocated spectrum, or allowance of sharing spectrum, are deemed irrelevant and its spectrum is reallocated and allowance of sharing spectrum is revoked.

The future of Amateur Radio is, mostly, collectively, in the hands of us Amateur Radio Operators. That's good news and bad news as leadership in Amateur Radio, in this era, is... challenged by our organizations being too tired, too focused on the past, not focused on the present and future (digital / data) or simply choosing that "the future of Amateur Radio isn't really our job".

Artificial Intelligence is Highly Overrated

I *wish* we were at the "totally awesome and completely competent" stage of evolution for Artificial Intelligence so I could make use of it. But it's not, thus I had to use *hours* of my time and *my* intelligence to create a *readable* transcript of a *portion* of the **NTIA 2024 Spectrum Policy Symposium**. If I had merely formatted the YouTube machine transcription into paragraphs, leaving in all the duplicated words, ums, you-knows, and run-on sentences, it would be complete unreadable after a few minutes. It would have been more expedient to only transcribe and lightly edit the statements of Phil Karn KA9Q2 on the panel, but then the context of KA9Q's remarks would be lost. I feel that the selected portion of this conference included in this issue was so significant to the mission of Zero Retries that I was willing to invest the hours that it took to create a readable transcript... even if it meant that this issue of Zero Retries probably won't publish at its usual time of 15:30 Pacific every Friday.

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What's new at Digital Library of Amateur Radio & Communications - February 2024

By Kay Savetz K6KJN

Greetings from DLARC World Headquarters, which is increasingly besieged with obsolete media. This month, cassette tapes were added to the stacks of CD-ROMs and floppy disks. There's huge news in these piles — let's get right to it.

The first huge news is about the Ham Radio & More radio show. As I mentioned last month, Len Winkler's radio show, which aired on commercial AM in Arizona, then moved to national syndication, aired from 1991 through 1997. Len digitized 149 episodes of his show years ago, then stopped (probably because the job is tedious and exacting. Can't blame him one bit!) Digitization paused for years, until last month, when he sent the cassette tapes of the episodes that he hadn't digitized. Using two audio digitization workstations running 16 hours a day, I digitized all of the other episodes and [added them to DLARC's HR&M collection](#). I added 169 episodes of the show that haven't been heard since they were first broadcast, for a total of 318 episodes! The collection represents nearly every episode of the show: only a few tapes went missing over the years or were unrepairable.

The new additions include interviews with [Wayne Green](#), Bill Pasternak ([this one](#) on the occasion of the 1,000th Amateur Radio Newline show in 1996 is fun), and [Fred Maia](#) of the W5YI Report. Many of the people interviewed on these 30-year-old episodes are Silent Keys now. Two episodes that caught my ear were Gary Froemming [talking about longwave listening](#) and Dr. Paul Shuch [discussing the search for extraterrestrial intelligence](#). Oh, and [the July 30, 1995 episode about "The Internet"](#) is a special time capsule: it was broadcast just 25 days before Windows 95 was released, which brought (sort of) easy Internet access to a wider public.

The Ham Radio & More collection is 470 hours of programming. I promise you'll find something of interest.

The second huge news is this: DLARC's massive manual scanning project is underway and it's already bringing results. A little backstory: This project began in 2015, when Manuals Plus, a company in Maryland, went out of business. Manuals Plus sold manuals — manuals for laboratory gear, test equipment, scientific instruments, just the most technical gadgets that you could possibly imagine. The story of how the manuals were saved from the recycling bin on short notice is fascinating (and accompanied by fantastic photos): you can read [part 1](#), [part 2](#), [part 3](#), and [part 4](#).

Then — not much happened with the manuals until August of last year, when I put out a call for volunteers to help sort through them. You see, the Manuals Plus manuals weren't all radio-related, but many were. So our plucky team of volunteers spent a day at the Internet Archive storage site sorting through pallets of manuals, picking out the ones that were at least radio-adjacent, the stuff that falls under the DLARC umbrella. We ended up shipping four pallets of manuals (of 28 bankers boxes each) to one of the Internet Archive's scanning centers. Manuals for signal generators, oscilloscopes, frequency counters, curve tracers, multimeters, sweep circuit analyzers, power supplies, and on and on.

Smash cut to today — the [manuals are being scanned are starting to appear in DLARC](#). As I write this, there are 954 manuals. There will probably be more

by the time you read this. When we're done with this first round, there should be about 4,000 manual scans. The scanners expect to be though with this pile in roughly six weeks.

Don't expect to see bog-standard manuals for Yaesu and Icom radios — we getting manuals from Marconi Instruments, Fluke, Sperry Gyroscope, Boonton Radio Company, and other companies from the amazing to the obscure, from the 1940s to the 2000s.

Four pallets, 4,000ish manuals, in a little over a month. The scope is boggling. And, this is just the first batch. There are many more pallets waiting to be scanned later this year.

In medium-sized news, the other Internet Archive scanning center has finished scanning five boxes of radio books from MIT that I mentioned last month. Currently there are [84 books in the Radio Books from MIT Libraries](#) collection: new additions include bound [annual volumes of The Wireless Age](#), more than a decade's worth of [Year-Books of Wireless Telegraphy & Telephony](#), and a Bell Telephone Laboratories treatise on [shortwave transatlantic radio-telephony](#). Also there's Ralph Preston Clarkson's 1927 light educational/history book "[The Hysterical Background of Radio](#)."

We've also added several club newsletters, including three from California clubs: 101 issues of [Golden Empire Amateur Radio Society "Radiator" newsletter](#), 175 issues of the [East Bay Amateur Radio Club "Blown Fuse" Newsletter](#), and 37 issues of the [Simi Settlers' Amateur Radio Club "Short Circuit" newsletter](#).

Several specialty clubs, focused on subject rather than geography, were added too: 158 issues of the [International Morse Preservation Society \(FISTS Club\) newsletter](#), 152 issues of the [RCA Amateur Radio Club newsletter](#) (for employees and former employees of RCA, GE, Thomson, Technicolor, and others), all 51 issues of the [Bicycle Mobile Hams of America](#) newsletter, and 11 issues of "[The Packet](#)", the newsletter of the defunct [Vancouver Amateur Digital Communications Group](#).

Pausing for dramatic effect and/or a deep breath... we also added 780+ editions of [The Blurb, the newsletter of Phil-Mont](#) (Warminster, Pennsylvania) Mobile Radio Club, going back to 1955 — most of which haven't been online before now ... and 170+ issues of the [Hannibal \(Missouri\) Amateur Radio Club Newsletter](#), which *not only* weren't available online until now, but club trustee Don Vary KD0HHN bravely rescued from old Iomega Zip disks!

David L. Mills — Internet pioneer, ham (W3HCF), and the man largely behind Network Time Protocol — died last month. I don't know how long [his web site](#) will endure, so I made sure it is backed up in The Wayback Machine, and I made a copy of his "scrabble of miscellaneous colloquium, seminar and meeting presentations" in a new [David L. Mills collection](#).

Last but not least, DLARC hosts a new collection called "[WWCT \(Peoria, IL\): An Oral History](#)." This labor of love is entirely the work of Tom Arbogast, who documented the history of the Peoria, IL FM station through fifty interviews of people who worked for the station, worked at competing stations, or covered the station in local media. He aptly describes the project as: "Collectively, these interviews represent the oral history of WWCT as told through their memories, experiences, and stories of their experiences at WWCT." It's a beautifully produced record of a commercial radio station that has been part of its community for more than 50 years.

Finally finally, the library has new needs and questions for *you* from the [DLARC Wantlist](#): What was the final issue of Radio Fun magazine? If there were issue numbers greater than 51, we need those. Do you have issues of Amateur Radio Trader magazine? We got the OK to scan all of them, but I don't think many people saved them like they do the glossy radio magazines.

We're also on the hunt for anything from the Montreal (QC) Amateur Radio Club in the late 1970s relating to the development of the first Amateur Radio Packet Radio experiments, especially newsletters; anything from Ottawa (ON) Amateur Radio Club Packet Working Group relating to high speed Packet Radio, especially the "Packet Interface" card that they developed, and any newsletters; anything from the Vancouver Amateur Digital Communications Group (VADCG); and anything from the Georgia Radio Amateur Packet Enthusiasts Society (GRAPES) regarding the WA4DSY / Heatherington 56k Packet Radio modem.

Digital Library of Amateur Radio & Communications is funded by a grant from Amateur Radio Digital Communications ([ARDC](#)) to create a free digital library for the radio community, researchers, educators, and students. If have questions about the project or material to contribute, contact me at kay@archive.org.

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[The National Spectrum Strategy](#)

This excerpt is included here as context to the following article. This might seem merely government policyspeak, but as you'll read in "Pillar Four", there is significant overlap with the potential future of Amateur Radio in this plan to develop what NTIA calls the "spectrum workforce". NTIA is the [National Telecommunications and Information Administration](#), sometimes referred to as the US Government's FCC as it administers the use of spectrum allocated to the US Federal Government, including spectrum allocated to use by the US Department of Defense. Hopefully you'll also see a number of themes I've been promoting here in Zero Retries. - Editor

November 13, 2023

President Biden has called radio frequency spectrum one of "our Nation's most important national resources." To promote innovation and U.S. leadership in wireless technologies, the Biden-Harris Administration has committed to careful planning and cooperation among government agencies and the private sector. As required by the Presidential Memorandum titled *Modernizing United States Spectrum Policy and Establishing a National Spectrum Strategy*, the Secretary of Commerce, through the National Telecommunications and Information Administration (NTIA), prepared this National Spectrum Strategy to both promote private-sector innovation and further the missions of federal departments and agencies, submitting it to the President through the Assistant to the President for National Security Affairs, the Assistant to the President for Economic Policy, and the Director of the Office of Science and Technology Policy.

The Strategy reflects collaboration with the Federal Communications Commission (FCC), recognizing the FCC's unique responsibilities with respect to non-Federal uses of spectrum, and coordination with other Federal departments and agencies (referred to collectively here as "agencies"). In carrying out this task, NTIA conducted extensive public outreach through a request for comment, two public listening sessions, two Tribal Nation consultations, and one-on-one meetings with stakeholders. NTIA has made this information, as well as supplemental comments filed by stakeholders, publicly available. NTIA also sought and received written comments and guidance from Federal agencies and hosted a Government-only listening session to gather additional

feedback.

The result is a comprehensive strategy to modernize spectrum policy and make the most efficient use possible of this vital national resource to enhance the quality of life for all Americans. This Strategy will expand access to advanced wireless broadband networks and technologies, whether terrestrial-, airspace-, satellite- or space-based, for all Americans. And it will drive technological innovation (including innovative spectrum sharing technologies); boost U.S. industrial competitiveness; protect the security of the American people; foster scientific advancements; promote digital equity and inclusion; and maintain U.S. leadership in global markets for wireless equipment and services, as well as innovative spectrum-sharing technologies—all essential priorities for the Biden Harris Administration.

...

Pillar Four | Expanded Spectrum Expertise and Elevated National Awareness

Preparing a well-trained U.S. workforce is essential to the policy proposals, potential investments in technologies, and research initiatives described in this Strategy. All stakeholders, including industry, academia, state, local and Tribal governments, as well as the Federal Government, must have a spectrum workforce with the necessary skills to work across current and emerging technologies.

We must also prepare the spectrum workforce of the next generation for a globally competitive environment where innovation is a key to successful national economic growth and spectrum access in support of critical Federal missions. We are committed to a diverse, broad-based workforce that enables the United States to maintain its global leadership.

Strategic Objective 4.1 | Attract, train, and grow the current and next- generation spectrum workforce.

Modernizing the spectrum workforce and preparing for the future is essential to foster innovation and to keep up with technological advancements, meet the growing demand for spectrum access, navigate our complex policy landscape, and maintain the Nation's continued economic growth. A well-trained workforce that can fill critical spectrum-related jobs across all relevant sectors is essential to ensuring that the spectrum ecosystem remains effective, efficient, and responsive to the evolving needs of the wireless ecosystem and society at large. Nurturing a skilled and diverse workforce will pave the way for long-term success and leadership in the spectrum domain, positioning the Nation at the forefront of emerging wireless technologies and their associated benefits. This Strategy will promote collaboration among industry stakeholders, academia, and government entities and serve as a catalyst for the development of specialized expertise.

Because a whole-of-government approach is necessary, the U.S. Government will develop and periodically update a National Spectrum Workforce Plan to prioritize development of, and enhancements to, the spectrum ecosystem workforce (including the full range of operational, technical, and policy positions involved in spectrum-related activities). As a first step, human resources professionals should conduct an analysis of the human capital needs for spectrum management and spectrum-related positions. This will help assess the need for modifications to Federal career series or enhancements to retain and attract quality talent.

Through the collaboration framework, academic institutions, Federal agencies, Tribal Nations, and private entities will identify needed education and training programs to equip the current workforce and prepare the future workforce to meet evolving and growing spectrum-related workforce demands. Organizations should encourage participation in conferences, trade shows, and other opportunities for informal collaboration and cross-stakeholder network building, such as through participation in technical and professional organizations. They should consider partnering with colleges and universities to develop programs that offer training in engineering skills to support analysis of spectrum issues, including a work-study program that could result in employment and leverage existing collaboration efforts.

Additionally, stakeholders should work with professional societies to define and update the knowledge needed to teach at different levels and to establish or expand new fellowship programs that place doctorate-level scientists in the U.S. Government and in organizations, as applicable. This would be particularly beneficial for U.S. spectrum-regulating agencies. Similar efforts should be undertaken to engage trade schools to develop and implement certification programs for targeted, spectrum-related skills sets.

The Administration will proactively engage agencies that invest in science, technology, engineering, and math (STEM) education to introduce spectrum topics at an early age and to stimulate students' interest in these careers through secondary education and beyond. It will be a priority to ensure more diversity by focusing educational development and recruitment efforts towards underrepresented groups, especially for young engineers. It is important to target outreach to underserved populations, such as Tribal communities, where a lack of internet access has disadvantaged many. In total, these efforts to attract top talent and develop spectrum expertise will benefit and serve the public interest at local, state, and Federal levels.

Strategic Objective 4.2 | Improve policymakers' understanding of spectrum considerations.

Making decisions for our Nation about the allocation and authorized uses of spectrum is a heavy responsibility. These decisions drive the development and deployment of new systems and technologies, so they have long-term and significant consequences. They require complex, cross-cutting understanding and knowledge of the technical aspects of spectrum use, the economic and legal implications of spectrum allocations, and the potential impacts to critical Federal missions. Weighing the trade-offs between current uses and impacts on incumbents against potential future applications is complicated, with many competing national interests at play.

Spectrum management is an interdisciplinary process that covers multiple intertwined factors, and few, if any, policymakers (e.g., regulators, legislators, community leaders, and spectrum managers) have expertise in all of the relevant fields. But leaders at all levels of government, including Tribal governments, need to understand spectrum issues holistically and have access to spectrum managers and professionals that understand the complexities relative to their interests. Recognizing this need and providing policymakers with foundational information and tools will serve the Nation well as we implement a more strategic spectrum planning process.

“Modernizing the spectrum workforce and preparing for the future is essential to foster innovation... and maintain the Nation's continued economic growth.”

The Administration will encourage policymakers at all levels to increase their understanding of spectrum topics such as electromagnetic propagation, spectrum science, spectrum engineering, spectrum management, and spectrum monitoring and measurements. U.S. spectrum-regulating agencies will generate avenues for decision-makers to enhance their understanding of spectrum policy and regulation, including the full range of spectrum management techniques such as spectrum sharing methodologies and licensing schemes, as well as knowledge of non-technical topics such as business models and economics associated with spectrum markets. Ensuring policymakers understand the value-based methodologies being created and their appropriate application will also be important.

Federal organizations that rely on spectrum to perform their missions will be encouraged to ensure sufficient spectrum expertise on their staffs and to train them to communicate in plain language with decision-makers. This will ensure that decisions are made after considering the full range of applicable technical and operational factors.

Strategic Objective 4.3 | Improve the public's understanding of radio frequency spectrum and raise awareness of its role in everyday life.

The radio frequency spectrum, while critical to our everyday lives, remains a complex resource often misunderstood by everyday users. Spectrum plays a vital role in Americans' daily activities, from education and emergency services to mapping and navigation systems, banking, e-commerce, and telemedicine, as well as for entertainment and staying connected through social media. The U.S. Government will prioritize educating the public about spectrum and the role it plays in their everyday lives and will consider a public service initiative. In addition to highlighting how citizens rely on, and benefit from, everyday spectrum usage, outreach could spotlight the crucial role of spectrum in critical government missions—especially those involving public safety, scientific endeavors (including weather and climate), and security. Ideally, showcasing the complexities and challenges of spectrum management will spark an interest among a broader community and attract multi-faceted problem solvers to the field.

The U.S. Government will work to raise the public's overall understanding and appreciation of spectrum and how this complex resource needs to be managed for everyday essential activities, both now and in the future. The more informed the public is, the better equipped it will be to weigh-in and have a voice in determining priorities for competing interests for spectrum access.

...

As you can see... some elements of "Pillar Four" are immediately adjacent to some of the primary attributes of Amateur Radio, such as:

The Administration will proactively engage agencies that invest in science, technology, engineering, and math (STEM) education to introduce spectrum topics at an early age and to stimulate students' interest in these careers through secondary education and beyond. It will be a priority to ensure more diversity by focusing educational development and recruitment efforts towards underrepresented groups, especially for young engineers.

One analog to the role that Amateur Radio can play in developing the "spectrum workforce" is the [Civil Air Patrol \(CAP\)](#)'s role in improving the pipeline of pilots and developing familiarity with aviation technology for recruits into the US Air Force, of which CAP is an auxiliary organization:

...[promote] aviation and related fields through aerospace/STEM education and helping shape future leaders through CAP's cadet program.

It's damning that Amateur Radio is apparently so poorly known or regarded within the US government, especially if the FCC was actually a partner in the formation of the National Spectrum Strategy, ***to not merit a single mention*** (that I saw, though I have not read this report line by line). ***We really need to fix this.*** Hopefully we made some progress in the followup NTIA 2024 Spectrum Policy Symposium - see next article.

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NTIA 2024 Spectrum Policy Symposium - Pillar 4 Panel Discussion Transcript, Part 1

Transcript extracted from YouTube, cleaned up, formatted, and (lightly) edited by Steve Stroh N8GNJ

The National Telecommunications and Information Administration (NTIA) held its sixth Spectrum Policy Symposium at the National Press Club in Washington DC on February 1, 2024. This year's Symposium will focus on implementation of the National Spectrum Strategy, including panel discussions aligned with each pillar of the strategy, highlighted by keynote remarks from policymakers from the White House, Congress, the Department of Commerce, the Department of Defense, and the Federal Communications Commission. The portion of the symposium relevant to Amateur Radio and its potential role, is:

Pillar 4 Panel Discussion: Growth of the spectrum Workforce, Increased Understanding of spectrum, and Raised Awareness of spectrum's Importance to the Country.

My thanks to the Internet Archive for making this video available in a permanent state, not subject to the vagaries of individual YouTube channels, advertisements, etc.

https://archive.org/details/ntia-spectrum-policy-symposium/08_Pillar_4_Growth_of_the_Spectrum_Workforce_0001.mp4

Moderator: Phil Murphy

The Strategy has identified a clear vision for raising the profile of spectrum as a career field and for greater awareness by Congress, policymakers and the general public. The call is for ambitious education and workforce development goals, including the creation of a National spectrum Workforce Plan.

Panelists:

- RJ Balanga, Deputy Director, spectrum Policy and Planning Division, NASA
- Dr. Sheryl Genco, VP-Advanced Technology, Ericsson
- Phil Karn [KA9Q], President, Amateur Radio Digital Communications (ARDC)
- Dr. Nick Laneman [ex-KC9NAJ], Director of spectrumX and Co-Director of the Wireless Institute at University of Notre Dame.

Murphy:

First off I just want to thank our panelists for joining us here today and I want to thank those of you here in the room and watching online. We're here

today to talk about pillar four the National Spectrum Strategy which is focused on growing our spectrum workforce raising awareness and understanding about this critical resource.

You've heard a lot today about the need for more spectrum by both the federal government and the private sector and I hope it's clear that we're seeing a lot of demand from all parties. As the private sector is increasingly relying on spectrum to develop new products and services, federal agencies are using spectrum in new and innovative ways to advance their missions as well. Through the other pillars of the strategy we're working to find a way to ensure that we have the spectrum resources to do both. This panel and this pillar of the strategy is really focused on the question of how we ensure that we have the workforce and the talent to make use of this spectrum and these new opportunities

How do we raise public awareness about how important this resource is and how important it increasingly is becoming, and then ultimately an understanding by policy makers about what this stuff is that we're talking about here and why it's so valuable, and ultimately how we make good decisions about how we use now and in the future as we're thinking about how we allocate it.

We've got an excellent panel of folks here who spent much of their lives thinking about these issues and working on solutions. First off we've got RJ Balanga; he serves as Deputy Director at the spectrum and Policy Planning Division at NASA Headquarters. RJ joined NASA in November 2015 and currently serves as Principal Advisor to the spectrum Policy and Planning Director. He also leads various NASA strategic initiatives focused on spectrum professional education and outreach initiatives.

Next we have Dr. Sheryl Genco, Vice President of Advanced Technology at Ericsson. She also serves on the executive committee of the National spectrum Consortium. Sheryl was also the Laboratory Director at NTIA's Institute for Telecommunication Sciences in Boulder and is a former colleague. Her contributions have been at the forefront of critical technology areas impacting Federal and Commercial programs including spectrum efficiency, sharing, auctions, 5G, broadband satellite communications, unmanned aviation systems, and radio sciences.

Next we've got Dr. Nick Laneman, the founding director of SpectrumX, an NSF spectrum Innovation Center and co-director of the Wireless Institute in the College of Engineering, and a professor in the Department of Electrical Engineering at the University of Notre Dame. He joined the faculty in 2002 shortly after earning his Ph.D. in Electrical Engineering and Computer Science from MIT. His research areas include Wireless System Design, Radio spectrum Access, Technology Standards, Intellectual Property, and Regulatory Policy.

Finally we have Phil Karn. Phil is past President and current Director of [Amateur] Radio Digital Communications, Inc. He was a radio amateur in high school and this was central to his pursuit of Electrical Engineering degrees at Cornell and CMU and a career and applied research at Bell Labs, Bell Communications Research, and Qualcomm where he made pioneering contributions to digital radio communications. He's retired but remains incredibly active in amateur radio, at ARDC, by mentoring local high school radio clubs, and by writing and distributing open source software including multi channel software defined radio. [His] amateur radio call sign is KA9Q.

We have a really amazing panel for you and I think it's going to be a really interesting discussion. I'm going to ask a question to all the panelists. We're going to sort of go down the line. spectrum is the driving force behind so many of the technologies and innovations that we rely on every day, from 5G to Wi-Fi to weather prediction and GPS. It's a resource that's very heavily used by both the federal government and the private sector and it's something people take for granted and don't really understand. I've been working in this space for a long time and my wife still doesn't understand what I do. I think one of the strategic objectives of pillar four of the National spectrum Strategy is to improve the public understanding about what spectrum's role is in everyday life, to tell that story. Why did each of your organizations care so much about spectrum and how does telling that story help you educate and engage the public?

RJ, how does NASA view this?

Balanga:

Well first of all Phil, thank you for having me. It's great to be on this panel especially now that there is inclusion of this workforce development pillar onto that national level. From a NASA standpoint, as we know, at NASA we do a lot of things for utilizing wireless spectrum, from space and human space flight, science, and the one thing you can't forget is the first "A" in NASA is the aeronautic side of things. Not only are our missions and science projects help with the understanding of our planet, the way we do business, and space and the celestial bodies. We are an organization that's always been developing emerging technologies and we use those emerging technologies. We put them out into the public domain as spin-offs and then the public utilizes them for everyday uses for other things.

Much of what NASA does for the human race is tied to spectrum. You know, the human spaceflight, satellite communication and navigation, observing the Earth and of course science like we said already. You know I think it's unfair that I go first here because storytelling is easy for NASA. You know the NASA brand, the NASA product, the NASA logo is very recognizable and it's global. So everybody wants to listen to NASA. They want to hear, they want to engage, but to take that piece back, it's part of that storytelling. How do we say, in our words, in our narratives, to tie in spectrum? The use of spectrum, the necessity of spectrum, the criticality of spectrum. Engaging with those who are not familiar with spectrum and get them interested and learning more about spectrum. So, thank you.

Genco:

Hi everybody. So while NASA has the NASA cachet, Ericsson brings you all your cat videos. So right now I am with Ericsson. I'm the Vice President of Advanced Technology and what I bring to Ericsson is my absolute love for knowledge, absolute love for continuous learning, and for engineering.

As an Electrical Engineer, you know I can geek out with the best of 'em and as a lot of you in this room know that's really where I sit - in that Innovation space that some of our guests were speaking about earlier today. So as far as Ericsson goes, Ericsson's a hardcore engineering company. I have never been surrounded by so many really deep technical people in my life. It's been really very exciting to be there. They really embrace everything that spectrum has to offer from Ericsson's standpoint. What they also do is, Ericsson and myself, they allow this whole idea of continuous learning, this whole idea of getting the word out, this whole idea of having a technical leadership around important areas such as spectrum.

You know "Coop" [Charles Cooper?] is probably the coolest cat in the room because of spectrum, right? So there's a number of pieces I think we're going to get to. As far as how I personally support our workforce development, I must say that that's really one of the best parts of my job is in all the workforce development activities and my passion that I have for STEM education. Just last year RJ and I probably talked for about an hour about STEM education and I'm always on Nick's back about sending me some more Electrical Engineers. With that I'm going to turn it over to Nick and we'll have more of a conversation about other ways that we use spectrum and educate the community.

Laneman:

Thank you Cheryl. It's good to have you on my back. I was a little hesitant when RJ brought up NASA's brand. I don't know if I should bring up Notre Dame's brand - there's probably the go-to of Notre Dame football but I guess I do want to stress that Notre Dame's mission is to be a force for good in the world. That phrase "force for good" was brought up earlier today and it really resonates. As Phil said I have two hats; I do teaching and research as a faculty member at Notre Dame and I help lead a wireless center that focuses on research and teaching there. I also am leading the NSF SpectrumX Innovation Center and that involves 30 universities. At this 30 member institutions, mostly universities, and so really what we're trying to do is create opportunities for students and faculty and increasingly public scholarship being able to contribute to this ecosystem and help address problems. And, along the way, train our students and create opportunities for those students. There's tremendous work that needs to be done and it's very exciting and increasingly the faculty are starting to see that there's more that they can learn themselves. We're developing the faculty expertise along the way because of this broad set of exciting uses around the radio spectrum. I'll pause there.

Karn:

Okay, I wanted to say that basically that Amateur Radio which probably most of you have heard of, is, well it's thought of as a nominally recreational service. People go in as a hobby and you know you could think of it as a National Park System to the airwaves. But, it's doing much more than that. I see it fundamentally, having been involved in it for, what, 52 years now, as an educational system. It's much more informal than you might think of as going to school, although it's often worked into school programs as well.

But it's a type of education that involves very hands-on intuitive learning that is really almost impossible to get in any other way. In fact I've interviewed probably hundreds of candidates to become colleagues, engineers in my career and one of the things I always looked for was a ham radio license. Of course that was especially true at Qualcomm since we did radio. But people who came in as hams, especially the students... I mean they had just a different take on things. They had a much more intuitive understanding because they had done this themselves. They had learned through Amateur Radio and we were rarely disappointed. Several of Qualcomm's founders were radio hams and they also had what I would consider a very intuitive understanding, especially things like propagation.

I heard in an earlier panel session that we needed to know more about propagation. Well, hams have been intensely interested in propagation since the service was created. Hams also talk to each other; we coordinate. Believe me if I get on the air and I transmit something that interferes, I will hear about it. OK, so I was surprised to hear that there was a problem in some other services about coordination during some of the spectrum sharing. So Amateur Radio, while it's nominally a hobby, most people think of it that way, it really is an educational service and I think that's why it needs to be protected and prepared.

It has small allocations all the way from the low frequency band up through the millimeter wave band which as you know have vastly different properties and propagation characteristics. That encourages, of course, experimentation and familiarization with all of them. It not only does it cause... and help people to learn, it brings many of them into STEM fields, specifically Electrical Engineering. I'm an example - my own fascination with ham radio began during the Apollo program which I guess dates me. I was fascinated by the fact that it took a major national effort to send two men to the moon but that I, as an individual, could put up an antenna and hear them. One ham actually received Neil Armstrong's backpack transmitter during his moonwalk - he received it directly without even going through the relay system. To me that was just mind-blowing that an individual could do that and I just got fascinated. From there I went and got EE degrees and I went into my career starting at Bell Labs in applied research. All through this I was basically living... my whole life was basically communications, both the amateur side, my hobby side, and my professional life.

One of the things I want to say about ham radio when it comes to technical experimentation is we often do things before anybody else is interested. A good example of that is that in the mid 80s I wrote an Internet Protocol package for the PC. As far as I know it's the first one that was a complete implementation and we were running the internet protocols over radio in the 1980s when nobody else was interested. Nobody else could even see any use for this. I mean it's hard to believe now but that really was true but because I did that I got the attention of some of the guys at Qualcomm, specifically the hams and they brought me out there. I started marrying this technology with their CDMA digital technology that they were developing in the mid 90s and even there I had a hard time selling everybody why would you want to carry a fax machine down the street to send data. That didn't make sense to anybody but I think I won out in the end. I think I showed that there was a use for this.

That's another thing about ham radio I think is fascinating is that we do stuff simply because it's fun and that's often long before anybody has any thought of doing commercial use of this stuff. As far as I know the only other people doing this at that time were the military and doing it with extremely expensive hardware. We were doing it with something we could afford as individuals. So not only did we experiment, we innovate, and we educate. I think we also innovate and often very early... much earlier you might think.

Murphy:

So another strategic objective of Pillar Four is really to attract, train, and grow that next generation spectrum Workforce. RJ, NASA's really leading the way within the federal government in terms of education outreach, training and this is really a passion of yours. How is it critical to NASA's goals for exploration and discovery to have a world leading workforce in spectrum related fields, and what are the initiatives that you guys have launched to achieve those?

Balanga:

Thanks Phil. First of all I just want to say thank you to my leadership. Without leadership and without their advocacy, without their investments, none of what we've been doing in SPEARS that's Spectrum Education Awareness... I'll talk a little bit more about that - one of our initiatives... would not be possible. That's one of the things that we need to do as we progress Pillar Four is obtain the advocacy, all the way from our leadership within our agencies but also across the federal government. We need to start talking and collaborating like we do on spectrum issues and spectrum challenges every day, but this is just another challenge. It's a spectrum workforce gap. One of NASA's goals is to support the National Space Council and their priorities. Within the National Space Council, one of their priorities and one of their goals is to ensure and sustain US leadership in space.

When I look at that, when I read that, and I interpret that, that's not just NASA but that's our brothers and sisters in the federal agency NOAA, the DOD, as well as our commercial partners. But it doesn't stop there, it's global. We work in tandem and we collaborate with a lot of international spectrum partners. When we continue that leadership in space and marrying that up with education and trying to ensure that the US is leading that forefront, we are outreaching to those domestic partners as well as international partners. We've been working with some countries like Germany and Nigeria because they just don't have the mechanisms already in place to educate new workforce.

On that same token there's emerging countries out there, from developing nations as well, that are also coming in and want to be involved in that space race, so we are also helping them to educate their workforce with processes and just basic understanding of the technical. One of the other things that we want to ensure with all of this, going back to the initiatives question that you had, we started SPEARS, the Spectrum Education Awareness investigations back in 2018. We've been implementing activities from 2019 until now. We're on phase two of our work efforts there and we're looking at a four phase approach when we first stood this up. It's to educate our spectrum professionals, that's one. Then also our spectrum user community, two. The other,

number three, is our spectrum partners and collaborators. Not everybody knows about space, not everyone knows about science, so we have to educate them as well - how do we do business. Then of course the fourth pillar there is reach out like what Cheryl and Nick are doing. It's engaging that STEM community; we have to create that interest into spectrum so we can have a robust pipeline of folks coming in. There's a whole bunch of other different stories behind that, or challenges. One is educating and creating and generating that interest, but then it's that pipeline. How do we ensure that there are positions for these younger generations to come in and fulfill?

Murphy:

It's a great point and I think we see a lot of need on the federal side. Cheryl, you've seen this issue from the federal side when you were a director at ITS but also now at Ericsson and other positions in the private sector. When you think about the fierce competitive challenges in selling radios and radio access networks globally, what steps is the wireless industry taking to recruit talent and make sure you have the human capital to be competitive?

Genco:

That's that's a great question, so just a little bit more, I just want to just riff a little bit on what Phil said, I think we have to somehow make it fun because I'm in this because it's fun. I think it's fun to do things in the labs and I think that's how I got involved in it and we have to somehow make it all fun. I'm going to tell a little bit of a story and then I'll answer your question. During COVID my children came home and they were in college. I've donated two engineers to the world by the way. My one daughter was taking some courses with a professor and she started screaming "Mom you've got to come here and listen to this!" He started talking about NTIA, and I was at ITS at the time. I said "oh my goodness, what's he saying?". Well, he was very thoughtful - what he was saying was how in the past perhaps more non-technical folks were making a lot of the policy decisions and were having most of the input into the spectrum decisions and how going forward that spectrum is getting so crowded and it's getting so much more complex that we need more and more technical people.

With that you know of course reached out to Joseph (he's at Northeastern by the way) he's a great guy, a Terahertz guy, and we had this great conversation about how we can energize the people that he teaches, for example, at Northeastern, to get into spectrum and to go into these fields. So it's real for me, it's real on a lot of levels. What does Ericsson do? Well, Ericsson allows me to come here and speak to you all about these things as well as supports the National Spectrum Consortium on which I sit as an executive committee member. The last two years the National Spectrum Consortium and Ericsson and its membership of 400 some odd companies and universities have started a national scholarship for college age women in spectrum.

In the last two years we've awarded seven scholarships and have had one more fantastic recipient than the next, and all those interviews and whatnot are on the National Spectrum Consortium's YouTube channel. Suffice to say we're really trying to get those kinds of things in place. The last thing as far as Ericsson goes from soup to nuts and we have four centers of excellence where we do training and upskilling of workers to do tower climbing and to install the systems. It's a very technical part of the job as well as physical, because they have to have the microwave orientations, they have to understand how to do that, how to read various diagnostic equipment to put these things up. It's quite spectacular, these centers of excellence.

I just want to point to the fact that yes, STEM is super important, but not everybody has to be in front of a computer screen. There's a certain amount of STEM that happens out there in the wild as well. Finally in Ericsson we have our Texas smart factory where we have 5G [that's] making 5G. It's super cool; you guys if you ever get a chance to see it it's really cool to see what we've done there because we've used industrial IOT technology. We use 5G technology, we were able to take a whole team of like five people who all came from Chipotle. Literally we got this one woman who's spectacular. First, we trained her up and then she said I know some other people that would love to come here and work and so there's this whole team, and they're like our best technical team in that factory, and they're spectacular.

So this whole idea of continuous learning, upskilling, supporting our engineers as they go through school and as they have opportunities to have internships is really a bunch of very important steps towards getting that workforce established for our country.

Karn:

Do you encourage them to get their ham licenses?

Genco:

You know that's funny because I used to have my own company and if they used to work on cars, I would hire them. So I had a similar thing but not the ham licenses.

Murphy:

It's an interesting idea - we're going to get into it in a little bit.

Nick, you know I think as an educator and running a research institution, getting people in spectrum can be challenging at universities particularly when there's a lot of competition for majors and getting students interested early on, particularly for something that's complex and esoteric in some respects like spectrum. How do you get folks interested, to Sheryl's point, how do you make it fun for them? You sort of mentioned getting your colleagues interested as well, people who maybe are working in a STEM field but not working on spectrum. It seems like SpectrumX sort of sits at the heart of that, trying to create those interdisciplinary connections, not just to bring people in, but also to kind of draw people together.

Laneman:

Thanks for the question. It's been an interesting journey. We've seen in the last 15 years or so a decline, generally speaking, in the interest in Electrical Engineering which is one of the foundations of RF and spectrum related work. So there's kind of an existential crisis in some sense to try to find ways to attract more students to Electrical Engineering in particular, but you know these related fields in general. The way that we've been approaching it is trying to better understand the why. Why is spectrum so important, and tell that story, before we teach the Fourier Transform, right? When I was a student, probably when many of us were students, we took the signals and systems class and learned all the math and did those problems. But, I had no sense of the many many many amazing applications of that concept and those technologies at the time. So we've kind of flipped the script. We start with the why, we talk about these different uses of spectrum, we talk about how important they are in society, and then that motivates diving deeper and developing the theory.

So that's one approach that we're doing, both in my class and in our center and getting undergrads involved in research. Often we try to make sure that we identify opportunities for the students so what's the career trajectory, what's the pathway from taking the signals and systems class to being a spectrum leader. I think that's why, among many reasons, we appreciate what NASA's been doing in the SPEARS effort because it helps us characterize what the opportunities are in the federal government and more broadly around spectrum careers.

The other thing that we try to do is that I take the mindset that I'll do just about anything twice. We're exploring new ways of collaborating, through SpectrumX in particular, and we try to explore an opportunity, distill it, simplify it, and then make it attractive to other faculty; try to make it easy for other faculty to get involved. As an example of that, we're really grateful NTIA has invested in some collaborations between faculty and SpectrumX and folks in ITS and also the Office of Spectrum Management. I took the lead on just trying to rough that out and get it started. It was painful getting all the documentation in place getting a CRADA ~~in place~~ ^{created} in place but it was well worth it. Now we have three more people taking on the role of a liaison working between SpectrumX and bringing other faculty in and working with NTIA. So being creative, looking for new ways to collaborate, breaking down barriers and silos. As hard as it is on the front end, it's worth it in the long term.

Murphy:

It's a great point.

Phil you're the Director of the Amateur Radio Digital Communications organization and it's really focused on empowering the future of Amateur Radio and digital communications and it seems like just in talking about this with you, you know there's a really big emphasis again on sort of making this fun. I think you know as we're talking about with Nick, there's real competition for kids' attention particularly kids, between you know their screens and other kinds of things that are trying to capture their attention. How are you guys trying to get them engaged, and get them to keep coming back and get them to potentially make this like a lifelong passion?

Karn:

First, let me say that ARDC is Amateur Radio Digital Communications. It's a nonprofit foundation that we formed in 2019 and we endowed it with the sale of some surplus IP addresses that we got in the early 80s specifically to run TCP/IP, the Internet protocols over radio - my project, I totally came across that. We make grants of about \$5 million a year and we make them spread across education, research and development, and general R&D. We're new at this - we only started this in 2019 so we're still finding our way to find out what does what you're talking about. We put money into just straight scholarships, we put money into educational programs that are brought to us and described to us. We also try to fund R&D projects that are specifically ham related and are also open source. We will not fund anything that's proprietary; it has to be made open to the whole amateur community. We're still feeling our way around on that.

I mean we sort of have an intuitive feel from having been a student myself, and most of the other directors having come from very similar backgrounds. We know that by making it fun, by getting them young, that's an important thing. I became a ham at 15, I think I was an old man by that time, there were a lot of hams I've known that were much younger than me, and just emphasizing a sense of fun. Kids learn best when they don't realize they're learning, right? I mean that's a cliché but it's true, right? Later on, I discovered when I went to school, for example, when I sat in a class on plasma physics that hey, this is how the ionosphere works! This actually makes sense to me now.

You were talking about sitting in Signals and Systems [class] - I didn't have that experience. I knew what this stuff was all about. Having a ham license actually helped in my engineering education when I got that far, and of course the education filled a lot of holes. There's still a very good reason to go to school - it fills in a lot that you don't know. But it does instill this sense of fun early on. We would like to get them young because that's when kids are still very curious. Unfortunately, a lot of schools beat out of the kids, once they get older, is a sense of curiosity. We would really like to take advantage of that when we can.

Murphy:

I think it's a great point. It strikes me, Phil and Nick, that both of your organizations are really focused on engaging young people and getting them to engage in the subject matter and to think about this like an ongoing interest. But, as we think about the sort of pressures that you all have talked about, of the kind of spectrum workforce, and the need to really expand the pool, I'm kind of curious what your organizations are doing to engage women and girls and communities that are traditionally underserved.

I'm going to ask RJ and Sheryl the sort of same question, but for you guys I know your organizations have been working on this issue and it is a passion. As you're thinking about how do we solve this challenge and really, it seems to some extent like it's expanding the scope and trying to bring people in who've been potentially historically excluded.

Karn:

We've given grants to some Indian tribes in remote areas; specifically they set Wi-Fi networks. It wasn't actually ham radio but it was Wi-Fi. We have given a grant to, example, the Society of Women Engineers. We're looking around. We found a few minority scholarship funds but you know, as I said, we've only been at this for about four years. Ask us in a while; we might have a better idea, but we're looking for answers, we're looking for ideas. Oh, by the way, I should mention earlier that NASA and the Amateur Service have had a long, very productive partnership. Hams have been launching satellites since literally the early 60s. The first amateur satellites went... the cubesat concept which some of you may have heard about, that comes out of ham radio. We invented that, until it took off and eclipsed us. Then there is the space station - there was an amateur radio and the International Space Station project which has gone on now for quite some time and is really successful. Space just still excites kids that seems to be an unchanging fact. So space is just this wonderful way to get kids hooked. The first time I watched an ARISS contact in person and I saw the looks on these kids' faces, you know when the astronauts talk back to them... I said we got to do this, we have to fund this. This is a really good idea, as simple as it seems. Just talking to an astronaut seems simple enough. It just gets these kids hooked in a way that I've never seen or rarely see anything else do. So little things like that, even if they may seem like gimmicks, you know to a kid they work. We've got to keep finding them.

Murphy:

There's some magic in NASA.

Karn:

There's some magic, yeah.

Laneman:

Let me try to summarize some of the activities that SpectrumX is pursuing. Just to take a step back, as I said, we're 30 institutions across the country primarily focusing on interdisciplinary research, policy, outreach and engagement to try to have an impact in the spectrum ecosystem. But a very important part of our mission as this national center for spectrum research and spectrum innovation is education and workforce development. We've spent a fair amount of time... we're about two years into our grant from NSF, which we're very grateful for. But we spent about a year in a planning process as well, so

we've been thinking about this problem for about three years and working on it. Because we're 30 institutions, we did not imagine that we could develop some kind of new degree program and have everybody agree to it. So what we've done instead is focus on developing courseware that can be reused at all of our institutions, and even more broadly. We're focusing on that at the middle school, high school level, at the undergraduate level. Then we've also got some introductory, interdisciplinary survey courses that we're developing at the Master's level. The idea is, again, raise awareness, build interest in the radio spectrum ecosystem as a whole. Because, that's really, I think one of the most attractive selling points to a young learner today is that if you develop a certain amount of expertise you've got job security because you have a lot of opportunities in this field. So we are developing that content in such a way... we're probably farthest along on the middle school high school materials. 20 lessons have been published at this point and they're distributed through the STEM education community. They can be downloaded and applied by any middle school or high school teacher.

We even have resources to train the teachers on how to use those materials. I'm happy to give you pointers to that if you know if your child is at a school and you want to get them exposed. If you've got nieces and nephews that you want to get them exposed through their schools, we can put those teachers in touch with these materials. The other dimension that we're pretty far along on is with the Master's level and in that activity we're really engaging the community. We're trying to bring in key representatives from different organizations, one of whom is up here on the stage with me from NASA. We want them to tell the story of their mission and the systems they're deploying, the frequencies that are relevant... maybe hint at some of the interference or coexistence issues that are out there. But for the most part, just, again, building interest and awareness so that students can get excited about the field and want to go take follow-on courses where they go deeper.

Again that stuff is developing, we're planning on three courses, they will ultimately be posted on Coursera so that someone can obtain a specialization in this field. All of the content will be reusable at our respective institutions for their for-credit offerings as well. So those are some ways that we're trying to engage and develop new innovative materials for educational purposes. We've also got some programs focused on undergraduate collaborative research, again with industry and government. We've also got some citizen science projects lined up where students can obtain a low cost RTL-SDR sensor and start to learn about the radio spectrum and take measurements in a relatively low cost, low barrier entry kind of way.

Karn:

I like the direct with the teachers. That's critical. My experience with high school clubs is you can't do anything without a motivated, involved teacher - really important.

...

End of Part 1 of this transcript. Part 2 will be published in Zero Retries 0139 next week.

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By Steve Stroh N8GNJ

Short mentions of Zero Retries Interesting items.

[Crucible Of Communications: How Amateur Radio Launched The Information Age And Brought High Tech To Life Part 2: Hams Bring Real-Time Communications To The World](#)

Until the birth of wireless at the end of the 19th century, the world had never known real-time ubiquitous communications. Printed newspapers of the day contained information that was often days, if not weeks, old with little hope of widespread verification of reported events. Part 1 of this series gave an overview of the fascinating hobby of ham radio, and showed how the grass roots effort of hobbyists and the sinking of the Titanic opened up the airwaves for the world's first amateur radio operators. Now, in Part 2, we see how amateur radio was at the forefront of the wireless revolution that brought AM and FM radio broadcasting, television, and mobile communications to the world. As shown here, it was the ingenuity and tenacity of hams that brought forth the information age in all of its forms.

This excellent 14-page scholarly article was published on 2023-11, but I only recently encountered a mention of it in a story by Andy Morrison K9AWM - HAMS GET CREDIT FOR ADVANCING THE INFORMATION AGE in [Amateur Radio Newslines Report 2413](#).

This article goes a long way in setting the stage for Amateur Radio as having been relevant to the evolution of radio (and other semiconductor-based) technology.

My thanks to Kay Savetz K6KJN employing their web-fu skills to locate the link to this latest installment. [Part 1 - The Birth and Breadth of the Ham Radio Hobby](#) was published in 2022-10 and since then I have been eagerly awaiting the future installments.

[Origins of Silicon Valley - Roots in Ham Radio](#)

Related to the previous article, from Amateur Radio Daily, 2024-01-31:

Paul Wesling (KM6LH) will present February 23, 2024 at the [California Historical Radio Society](#) (CHRS) and online via Zoom. In-person registration may be found [here](#), while registration for the Zoom link is [here](#).

Summary: Why did Silicon Valley come into being? The story goes back to local Hams (amateur radio operators) trying to break RCA's tube patents, "angel" investors, the sinking of the Titanic, Fred Terman and Stanford University, local invention of high-power tubes, WW II and radar, William Shockley's mother living in Palo Alto, and the SF Bay Area infrastructure that developed – these factors pretty much determined that the semiconductor and IC industries would be located in California's Santa Clara Valley, and that the Valley would remain the world's innovation center as new technologies emerged – computers, then software, mobile, biotech, Big Data, VR/AR, autonomous vehicles, blockchain, and now generative AI – and it would become the model for innovation worldwide.

A previous version of the presentation from 2023 may be viewed [here](#).

Apparently KM6LH has been presenting this talk for some years now. From ARRL News 2016-11-22:

[“The Origins of Silicon Valley: Roots in Ham Radio” Video Now Available](#)

The ARRL Centennial National Convention presentation, “The Origins of Silicon Valley: Roots in Ham Radio,” by Paul Wesling, KM6LH, has been edited into a [video](#) and is now available on YouTube.

“It tells of the interesting events in the maritime port of San Francisco at the turn of the 20th century, as early radio was being developed, and follows the hams who designed new devices and equipment to address steamship traffic plying the Pacific Ocean,” Wesling said. “Their efforts to break the east coast monopoly on tubes and to extend radio into the microwaves as the country approached World War II form the basis for what became Silicon Valley.”

Wesling said the presentation traces early vacuum tube development and other contributions by Bay Area amateurs, “and the continuing spirit of hobbyists and collaborators that fuel today’s high-tech mecca.” The presentation runs about 1 hour.

A graduate of Stanford University, Wesling, a IEEE/CPMT Society Distinguished Lecturer, retired from Hewlett Packard in 2001, and then served for 10 years as Communications Director for the IEEE’s San Francisco Bay Area Council.

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If you’re not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out

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Zero Retries Frequently Asked Questions (FAQs) — In development 2023-02.

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- [Jeff Davis KE9V](#) also mentions “Zero Retries Interesting” topics so regularly on his blog (that I otherwise wouldn’t know about) that I’ve bestowed on him the honorific of Pseudostaffer.

- [Amateur Radio Weekly](#) by Cale Mooth K4HCK is a weekly anthology of links to interesting Amateur Radio stories.
- [Experimental Radio News](#) by Bennet Z. Kobb AK4AV discusses (in detail) Experimental (Part 5) licenses issued by the US FCC. It's a *must-read-now* for me!
- [RTL-SDR Blog](#) - *Excellent* coverage of Software Defined Radio units.
- [TAPR Packet Status Register](#) has been published continuously since 1982.
- Other Substack Amateur Radio newsletters recommended by Zero Retries.

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- [HB9BLA Wireless](#) by Andreas Spiess HB9BLA
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- [Modern Ham](#) by Billy Penley KN4MKB
- [Tech Minds](#) by Matthew Miller M0DQW

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More bits from Steve Stroh N8GNJ:

- [SuperPacket blog](#) — *Discussing new generations of Amateur Radio Data Communications — beyond Packet Radio (a precursor to Zero Retries)*
- [N8GNJ blog](#) — *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs — Bellingham, Washington, USA*

Thanks for reading!

Steve Stroh N8GNJ / WRPS598 (He / Him / His)

These bits were handcrafted (by a mere human, not an Artificial Intelligence bot) in beautiful Bellingham ([The City of Subdued Excitement](#)), Washington, USA, and linked to the Internet via [Starlink Satellite Internet Access](#).

2024-02-09

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[1](#)

The issues of The Communicator that I've read of late are more than 100 pages - considerably beyond that of a typical newsletter...

[2](#)

As I was editing this transcript, I don't know if I was more gobsmacked to see Amateur Radio discussed as a peer to these very well funded efforts by Ericsson, NASA, and NTIA... or seeing Phil Karn KA9Q in a suit and tie.

3

Originally I heard this as "create" and showed it as [create?], but Zero Retries reader Doug Hutchison helpfully suggested that the mystery word was actually CRADA, an acronym for [Cooperative Research and Development Agreement](#), which fits nicely into the discussion.